INDIVIDUALIZED VS ECOLOGICAL AIR POLLUTION TIME SERIES: A COMPARATIVE STUDY OF MODELLING SPATIOTEMPORAL VARIABILITY

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Background and Aims: Studies of air pollution effects on health are often based on ecological measurements covering a large area with a few fixed monitoring sites. Recently several attempts are made to produce individualized exposure assessment appropriate for large scale use. We used a land use regression (LUR) model to assess daily exposure to NO_2 and PM_{10} for 50 addresses spread within the Greater Athens Area. This individualized exposure assessment was compared to a time-series of ecological measurements, based on the daily average from fixed monitoring sites that has been used in the past, in order to estimate exposure for all subjects.
Methods: We used semiparametric regression for modelling the spatiotemporal NO_2 and PM_{10} variability for geocoded addresses, using traffic load in a 100m radius buffer as well as daily meteorological variables. We evaluated the geographical variability introduced by the individualized time-series of NO_2 and PM_{10} concentrations in the study area using linear mixed models. We also assessed the validity of the individual series by comparing with the 2010 fixed site monitoring air pollution data which were not included in our model building process.
Results: We calculated the differences between the ecological and each individualized series. The mean difference (SD) was -3.26 (11.844) • g/m^3 ranging from -64.7 to 74.8 • g/m3. Thus the individualized series were on the average higher compared to the ecological series. The differences between ecological and each individualized series were higher in the summer by 5.26 (95%CI 4.86,5.65) • g/m^3 compared to the winter period and their median correlation was 0.67 (range 0.66-0.68). The model showed good validity with the 2010 data.
Conclusions: Our LUR model introduces substantial geographical variability and is well correlated with the ecological measurement on the time scale. It represents a substantial improvement over the ecological measurement for a more personalized exposure assessment.